ELEC 544 - Digital Signal Processing - 2014

Instructor: C. S. Burrus, Office Abercrombie 223A, Phone 5484, e-mail csb@rice.edu

Class: MWF at 10:00 am, Duncan-1075; Office hours: 11-12 MWF or by appointment

Graders: TBD

Structure: Three one-hour classes per week the first half or 2/3 of the semester, Two in-class, closed-book exams, computer assignments using *Matlab*, a project is done the second half of the semester and a report turned in. Course will be somewhat "flipped", meaning reading, video viewing, homework will be done at home before class and it will be discussed in class.

Information on *OwlSpace:* https://owlspace-ccm.rice.edu/portal

Prerequisite: Basic linear system theory that would cover Fourier analysis and frequency response. Introduction to discrete time systems (301 or 431) Computer programming (Matlab) is necessary.

Students: The course is suitable for seniors or graduate students majoring in any engineering, science, mathematics, or social science discipline.

Course Outline:

1. Review

- The DFT, z-transform, convolution, frequency response

2. Filter Design

- Approximation and realization
- FIR and IIR filters
- Multirate filters and filter banks

3. DSP Algorithms

- Fast Fourier Transform (FFT), sparse FFT
- Wavelet Transform
- High-Speed Convolution and correlation

4. Wavelet Theory and Transforms

- Multiresolution theory
- Filter bank theory
- Denoising and compression

5. Project: Groups of 2 or 3 will propose a project on filter design, algorithms, or wavelets and carry it out during the second half of the semester

Texts, Notes, and Reference Books (recommended, not required):

1. Burrus: *Digital Signal Processing and Filter Design*, Draft Book, Connexions and OwlSpace. http://cnx.org/content/col10598/latest/

2. Burrus: *Fast Fourier Transforms*, Draft Book, Connexions and OwlSpace. http://cnx.org/content/col10550/latest/

3. Burrus, et al: *Computer Based Exercises for Signal Processing using MatLab*, PH, 1994, 98

4. Burrus, Gopinath, and Guo: *Introduction to Wavelets and Wavelet Transforms*, PH, 1998. Also in Connexions: http://cnx.org/content/col11454/latest/

5. Baraniuk: *Signals and Systems*: Connexions http://cnx.org/content/col10064/latest/

6. Sharf: *A First Course in Electrical and Computer Engineering*, Connexions, http://cnx.org/content/col10685/latest/

7. Burrus: *A Brief Note on Signals and Systems*, http://cnx.org/content/col10565/latest/

8. Burrus: *Basic Vector Space Methods in Signal and Systems Theory*, http://cnx.org/content/col10636/latest/

Any student with a disability requiring accommodations in this course is encouraged to contact me after class by coming to my office, sending email, or by phone.